# Creating and Understanding Hybrid Interfaces of Multifunctional Composite Laminates for Extreme Environments

Completed Technology Project (2014 - 2018)

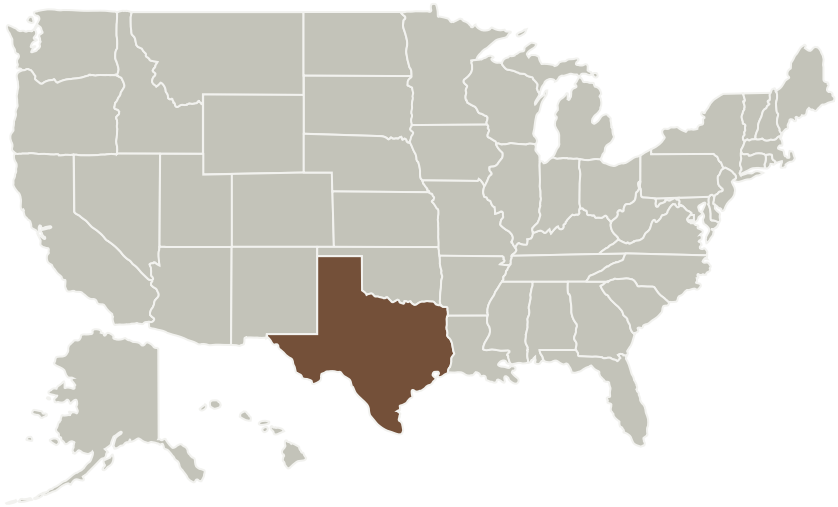
## Project Introduction

Due to increasing needs for lightweight and multifunctional structures and materials that can operate at and sustain the extreme environment such as high temperature and pressure, hybrid composites are of high interests and being developed recently. Because of the mismatch in properties of different layers, the interfacial regions in these hybrid systems are critical for reliability. The objectives of this work are to develop a robust and multifunctional interface between shape memory alloys and polymer matrix composite for hybrid materials that undergoes elevated temperatures at the operating environment. Functionalities of this interface include thermo-mechanical capability together with self-sensing and self-healing abilities. Approaches from experimental techniques for manufacturing and characterizing will be used. Computational models across the scales utilizing molecular dynamics, micromechanics and finite element methods will be developed to assist the understanding and interpreting the complex phenomena observed at the interface as well as to help design the interface that meets the specific needs.

## Anticipated Benefits

Hybrid composites are of high interest due to increasing needs for lightweight and multifunctional structures and materials that can operate at and sustain extreme environments such as high temperature and pressure. Because of the mismatch in properties of different layers, the interfacial regions in these hybrid systems are critical for reliability.

## Primary U.S. Work Locations and Key Partners

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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Responsible Program:**

Space Technology Research Grants

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Texas A & M University-College Station(Texas A&M) | Supporting Organization | Academia<br>Hispanic Serving Institutions (HSI) | College Station, Texas |

| Primary U.S. Work Locations |
|---|
| Texas |

**Project Website:**

https://www.nasa.gov/directorates/spacetech/home/index.html

## Project Management

**Program Director:**

Claudia M Meyer

**Program Manager:**

Hung D Nguyen

**Principal Investigator:**

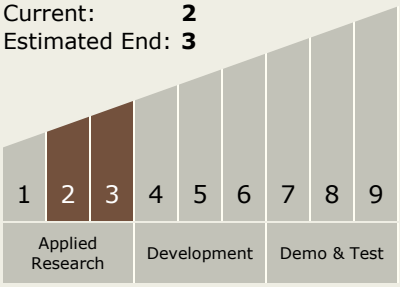
Ozden Ochoa

**Co-Investigator:**

Hieu Q Truong

## Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**




## Technology Areas

**Primary:**

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.7 Special Materials